Simpson

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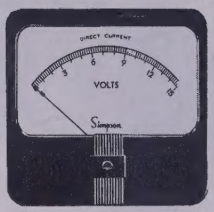
OPERATOR'S MANUAL

COLORSCOPE MODEL 458

SIMPSON ELECTRIC COMPANY
5200 W. Kinzie St., Chicago 44, Illinois, ES 9-1121
In Canada, Bach-Simpson, Ltd., London, Ontario

Simpson panel instruments.



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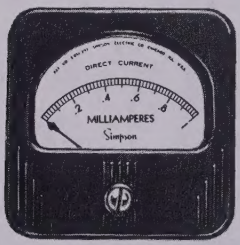
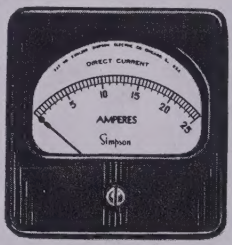
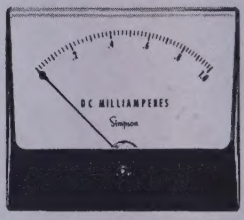


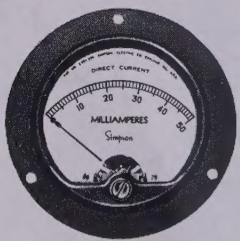
2½" RECTANGULAR
ACCURACY: ±2%
SCALE LENGTH: 1⅞"



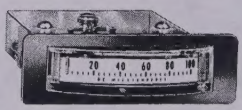
3½" RECTANGULAR
ACCURACY: ±2%
SCALE LENGTH: 2-9/16"



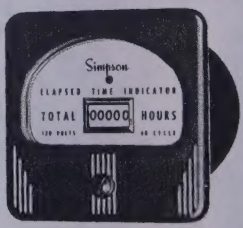
2½", 3½", 4½" WIDE VUE
ACCURACY: ±3%



2½" or 3½" ROUND
ACCURACY: ±2%
SCALE LENGTH: 1⅞"



EDGEWISE
ACCURACY: DC ±2%
SCALE LENGTH: 1⅞"



ELAPSED TIME INDICATOR
110/220 VOLTS

SIMPSON ELECTRIC COMPANY • CHICAGO 44, ILLINOIS

OPERATOR'S MANUAL

SIMPSON COLORSCOPE MODEL 458

SIMPSON ELECTRIC COMPANY
5200 W. Kinzie St., Chicago 44, Illinois. EStebrook 9-1121
In Canada, Bach-Simpson, Ltd., London, Ontario

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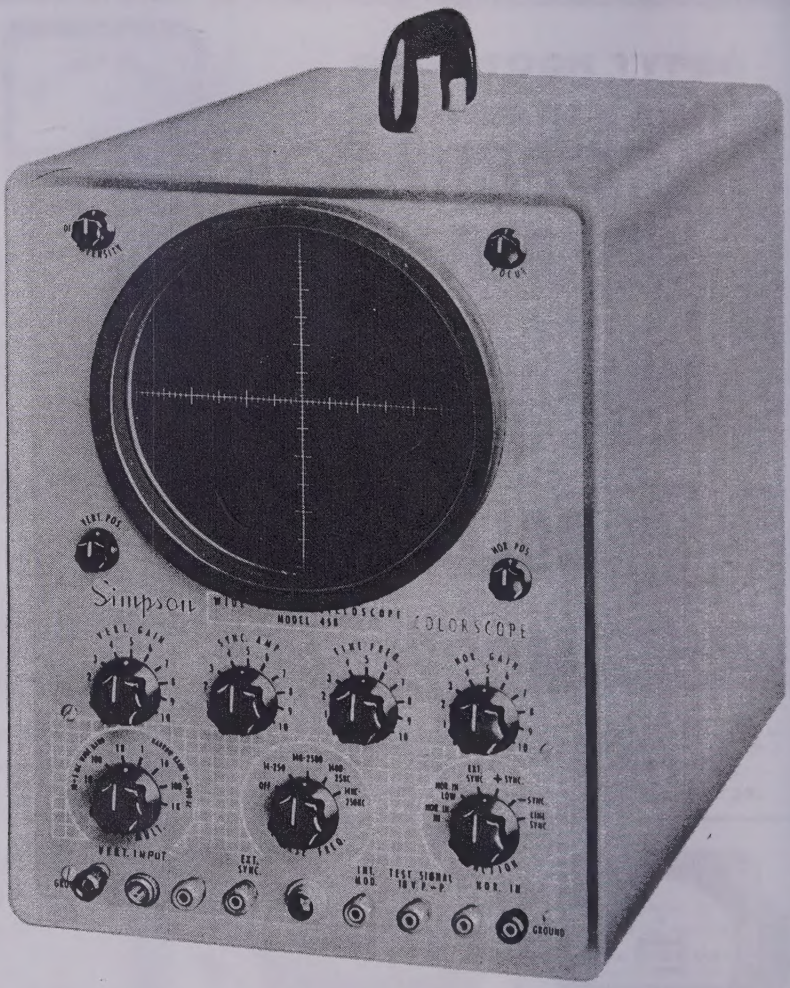


FIG. 1. SIMPSON COLORSCOPE, MODEL 458, FULL RESPONSE AT 5 MC, AND HIGH SENSITIVITY AT 300 KC PROVIDE COMPLETE FLEXIBILITY FOR TV SERVICE.

APPLICATIONS

The Simpson COLORSCOPE* Model 458 is the versatile 7-inch oscilloscope with 5 Mc/300kc bandwidth designed for *both* color and monochrome TV service.

The *adjustable bandwidth* and *sensitivity* permit an unusually wide range of applications in TV service, as well as in general-purpose electronic work. The Simpson COLORSCOPE Model 458 is also useful for *FM* and *AM radio service, for alignment, vibrator waveform tests, signal tracing, and power supply checks; in industrial electronic applications for maintenance and trouble-shooting of electronic welding controls, high speed measurements, phase determinations, watch timing, vibration and dynamic pressure analyses; in allied fields such as architecture for reverberation investigations and stress measurements; in high fidelity audio work, for distortion analysis, balance checks, and intermodulation tests; in the transmitting station for modulation measurements, impedance measurements, and signal monitoring.*

Schools find the Simpson COLORSCOPE Model 458 ideal for use in laboratories because of its moderate cost and high performance.

COLOR BURST

Good reproduction of synchronizing pulses with *accurate rendition of the color burst* is a prime consideration in choosing an oscilloscope for color-TV applications. Full response at burst frequency, with good phase response is assured by properly *compensated wide-band vertical amplifier stages.* Because high sensitivity is also required for signal-tracing procedures and for alignment of low-gain circuits such as are in front ends,

*Trade Mark

the Simpson COLORSCOPE Model 458 is provided with a *sensitivity-boost* switch, to increase the gain of the vertical amplifier by a factor of 3 at a bandwidth of 300 kc.

COMPENSATED STEP ATTENUATOR

The input signal to the COLORSCOPE Model 458 is first applied to a compensated step attenuator, which permits coarse control of the signal level without frequency or phase distortion. The step attenuator is of the decimal type, which facilitates measurement of *peak-to-peak* voltage values. A reference calibrating voltage of 18 peak-to-peak volts is available at a front panel terminal.

VERNIER VERTICAL ATTENUATOR

A vernier vertical attenuator is also provided for *continuous control* of the signal voltage; the vernier attenuator is designed as a cathode follower after the input preamplifier. The following two stages in the vertical channel are arranged as push-pull amplifiers, to provide phase inversion and *balanced deflection* to the cathode-ray tube. These latter stages are also arranged to provide a choice of wide-band operation at reduced gain, or high-sensitivity operation at reduced bandwidth. The sensitivity ratio is approximately 3 to 1 (40 to 15), with a maximum sensitivity of 15 mv per inch. The use of balanced deflection minimizes astigmatism with its accompanying defocussing at the edges of the screen, which occurs when single-ended deflection is utilized.

OFF-SCREEN VERTICAL DEFLECTION

When used in the high-sensitivity mode, the vertical amplifier provides off-screen vertical deflection; when used in the wide-

band mode, vertical deflection should be limited to an excursion of approximately four inches. The vertical-amplifier signal can be used to synchronize the horizontal sweep oscillator with either a *positive-going* or a *negative-going pulse,* which facilitates tight locking of patterns such as composite video waveforms. Alternatively, external synchronization can be utilized, or 60-cycle displays can be locked at power-line frequency by suitable setting of the sync-selector switch.

60 CYCLE SINE WAVE SWEEP TERMINALS

Terminals are provided for application of a phasable 60-cycle sine-wave sweep from an external source also, such as from a sweep generator. The output from the sawtooth generator is available at a front-panel terminal.

MODULATING VOLTAGE TO CRT GRID

A terminal is also provided for application of a modulating voltage to the grid of the cathode-ray tube for intensity modulation of the scope beam. Direct access is not provided to the deflection plates, inasmuch as the response of the vertical amplifier makes such expedients unnecessary for any usual application of the instrument.

FOR BEGINNERS

Operating controls of the COLORSCOPE Model 458 are conventional, and are not described in detail, as these functions are extensively discussed in most oscilloscope textbooks. However, beginners sometimes become confused by overload situations caused by *misadjustment of the vertical step attenuator* with respect to the applied input signal.

Since the step attenuator drives the grid of the first vertical amplifier stage, while the vernier attenuator operates in the cathode-follower circuit following the first amplifier stage, it is apparent that overload of the first stage can be avoided only by reduction in the setting of the step attenuator, and not by reduction in the setting of the vernier attenuator.

OVERLOAD CAUSED BY IMPROPER ATTENUATOR SETTINGS

This is a source of confusion to the beginner, who may understandably assume that functions of the step and vernier attenuators are completely equivalent. A good operating rule is to work the step attenuator at the lowest position, and the vernier attenuator at the highest position to properly accommodate the input signal voltage.

SYNC SELECTOR POLARITY

When a composite video signal is being viewed, the sync pulses may extend in either a positive or a negative direction. The setting of the *sync-selector switch* should correspond to the polarity of the pulses, to obtain most satisfactory sync lock. The composite video signal can usually be locked to the best advantage by using the EXT SYNC function of the instrument,

and placing a wire from the EXT SYNC post into the field of the deflection yoke or the field of the picture-tube screen.

ACCESSORY PROBES

Accessory probes, such as low-capacitance, demodulator, and capacitance-divider probes, may be used to extend the operating range of the instrument. In general, the operator should endeavor to make tests across a low-impedance circuit point. A *shielded input cable* can be connected at a *low-impedance point* in the circuit under test, without disturbing the circuit operation as a result of the capacitance of the shielded cable. *Open test leads* can also be used satisfactorily across *low-impedance circuit points,* since stray fields which may be picked up by the open leads produce a very small voltage drop across the low impedance.

TESTS AT HIGH IMPEDANCE POINTS

On the other hand, if a test must be made at a *high-impedance point* in a circuit, it becomes necessary to use a shielded cable to the scope to avoid excessive *pick-up of stray fields,* and a *low-capacitance probe* must be used with the input cable to minimize the amount of capacitance which is shunted across the high-impedance point. Other operating precautions are noted in the application section.

OVERLOAD PRECAUTION

When the band switch of the Simpson COLORSCOPE is set to the 5.0-Mc position, the vertical deflection should be limited to an excursion of approximately four inches. Otherwise, limiting and distortion of the peaks of the waveform may be encountered.

BURST DISPLAYS

The Simpson COLORSCOPE Model 458 has full gain at 3.58 Mc for proper display of the *color subcarrier burst* on the back porch of the horizontal sync pulse. Fig. 2 illustrates typical burst displays as observed in practical test work. The burst is first encountered in demodulated form at the output of the picture detector, as a component of the composite video signal. The

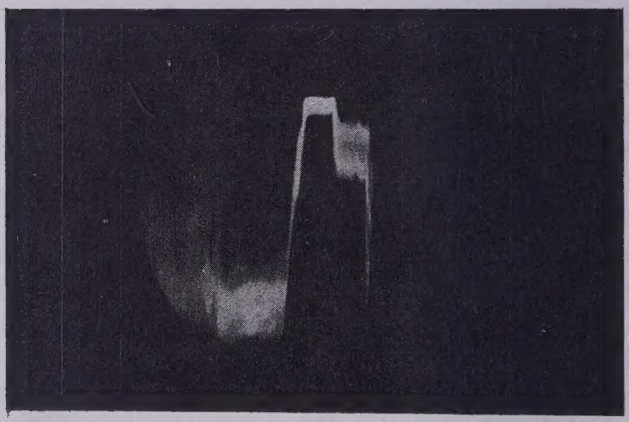


FIG. 2A. THE COLOR-SUBCARRIER BURST APPEARS FUZZY WHEN THE SIGNAL IS OBTAINED FROM A RECEIVER CIRCUIT, INSTEAD OF FROM A SYNC GENERATOR. THIS IS CAUSED BY THE NOISE VOLTAGES AND CROSS-BEATS WITH THE SOUND SIGNAL. INDIVIDUAL CYCLES OF THE BURST ARE INDISTINGUISHABLE UNDER MOST CONDITIONS.

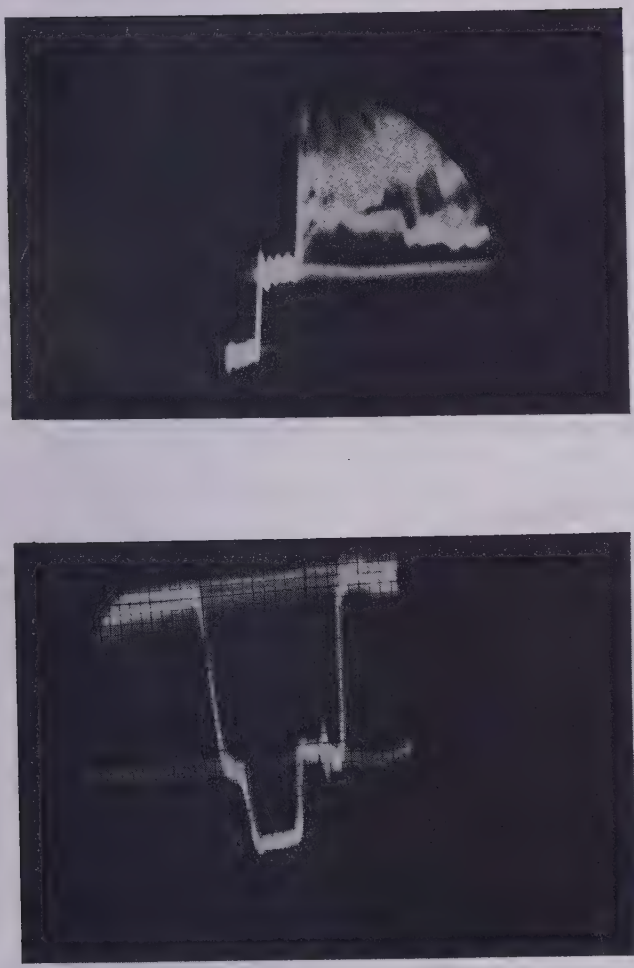
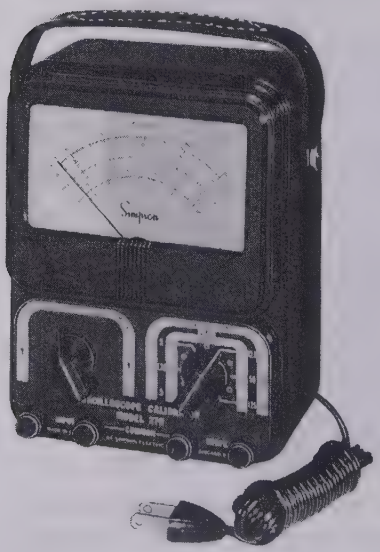


FIG. 2B. TWO DISPLAYS WHICH MAY BE CONFUSED WITH BURST; (ABOVE) 920-CPS BEAT BETWEEN SOUND CARRIER AND COLOR SUBCARRIER; (BELOW) TRANSIENT ON BACK PORCH OF HORIZONTAL SYNC PULSE DURING MONOCHROME TRANSMISSION AT COLOR-TV STATION.

burst voltage can be *traced step-by-step* from this point through the color-sync circuits, for purposes of troubleshooting. The peak-to-peak voltage of the burst at the picture detector is typically 0.5 volt.

PEAK-TO-PEAK VOLTAGE MEASUREMENTS

Measurement of the peak-to-peak voltage value of the composite video signal, or of any of its component voltages can be rapidly accomplished by calibrating the vertical amplifier of the instrument with the calibration voltage source which is provided. Alternatively, the *Simpson Scope CALIBRATOR Model 276* can be used for direct comparison and measurement of a wide range of peak-to-peak voltage values. Fig. 3 shows the external appearance of the CALIBRATOR Model 276.



RANGES, VOLTS

RMS: .36-.9-3.6-9-36-90

PEAK: .50-1.25-5-12.5-50-125

PEAK-TO-PEAK: 1.0-2.50-10-25-100-250

SIZE: $5\frac{1}{4}$" × 7" × $3\frac{1}{2}$"

NET WEIGHT: $2\frac{1}{2}$ LBS.

SHIPPING WEIGHT: 4 LBS.

POWER REQUIRED: 105-125 V. 60 CYCLES AC

DEALER'S NET PRICE $29.50

. . . EVEREADY VINYL CARRYING CASE FOR MODEL 276, #4236 . . . $8.75

(PRICES SUBJECT TO CHANGE WITHOUT NOTICE)

FIG. 3. EXTERNAL VIEW OF SIMPSON OSCILLOSCOPE CALIBRATOR MODEL 276.

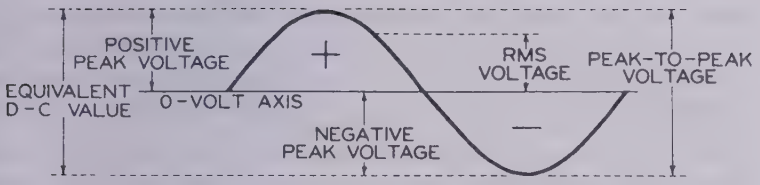


FIG. 4A. A SINE WAVE, WITH IMPORTANT COMPONENT VALUES INDICATED. THE PEAK-TO-PEAK VOLTAGE IS EQUAL TO THE COMPLETE EXCURSION FROM THE POSITIVE PEAK TO THE NEGATIVE PEAK.

THE POSITIVE-PEAK VOLTAGE IS EQUAL TO THE NEGATIVE-PEAK VOLTAGE, AND EITHER PEAK VOLTAGE IS EQUAL TO ONE-HALF OF THE PEAK-TO-PEAK VOLTAGE. THE RMS VOLTAGE IS EQUAL TO 0.707 OF THE PEAK VOLTAGE, OR, THE RMS VOLTAGE IS EQUAL TO 0.354 OF THE PEAK-TO-PEAK VOLTAGE. THE AVERAGE VALUE OF THE WAVEFORM IS ZERO. THE PEAK-TO-PEAK VOLTAGE IS EQUAL TO 2.83 TIMES THE RMS VOLTAGE.

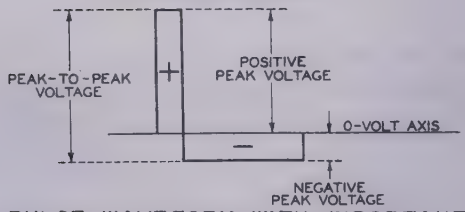
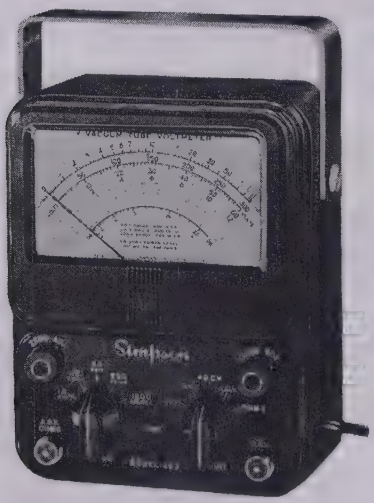


FIG. 4B. A PULSE WAVEFORM WITH IMPORTANT COMPONENT VALUES INDICATED. NOTE THAT THE POSITIVE-PEAK VOLTAGE IS NOT EQUAL TO THE NEGATIVE-PEAK VOLTAGE. HOWEVER, THE POSITIVE AREA OF THE WAVEFORM IS EQUAL TO ITS NEGATIVE AREA. THE SUM OF THE POSITIVE-PEAK AND NEGATIVE-PEAK VOLTAGES IS EQUAL TO THE PEAK-TO-PEAK VOLTAGE. SUCH A NON-SINUSOIDAL WAVEFORM HAS AN AVERAGE VALUE OF ZERO.



USE IT AS AN ELECTRONIC DC VOLTMETER, OHMMETER, AC OR AF VOLTMETER, RF VOLTMETER (WITH ACCESSORY PROBE), OUTPUT METER, AND FOR OTHER APPLICATIONS.

RANGES:

DC VOLTS: 1.2-12-60-300-1200

AC VOLTS: 1.2-12-60-300-1200

AF VOLTS: 1.2-12-60

RESISTANCE: 0 TO 1000 MEGOHMS IN 5 RANGES

DECIBELS: −20 TO +63 DB IN 5 RANGES

RF VOLTS: 20 VOLTS MAXIMUM

FREQUENCY RESPONSE: FLAT 20 KC TO 100 MC

DEALER'S NET PRICE, COMPLETE WITH DCV PROBE, ACV-OHMS PROBE, GROUND LEAD, OPERATOR'S MANUAL. $68.00

FIG. 4C. SIMPSON VACUUM TUBE VOLTMETER MODEL 303

FIGURE 4 RELATIONSHIPS

The basic relations between d-c, peak-to-peak, rms, and average voltages are shown in Fig. 4. It should be noted that *peak-to-peak values correspond to d-c values;* e.g., if 3 volts d-c is applied across the vertical-input terminals of the scope, the beam will undergo a transient deflection of 3 peak-to-peak volts. It should be noted also that the *rms values of a-c voltage indicated by service voltmeters apply only to sine waves;* non-sinusoidal waveforms can be practically specified only in terms of peak-to-peak voltage values. Although a non-sinusoidal wave-form will have some corresponding value of rms voltage, this rms value is is difficult to determine, and is of no practical importance in service work. Since a sine-wave voltage can be readily specified in terms of either rms voltage or peak-to-peak voltage, *the sine waveform provides the most convenient transition* from rms values indicated by a voltmeter to the peak-to-peak values utilized in scope voltage measurements.

ZERO VOLT AXIS

Note that the zero-volt axis shown in Figs. 4A and 4B represents the a-c zero-voltage level, and *is identified as the resting position of the scope trace* when no input signal is applied. Since the COLORSCOPE Model 458 is an a-c scope, the d-c volts zero level does not appear on the scope screen, but can be readily determined by *measurement with an accurate VTVM* such as the *Simpson Model 303.* (See figure 4C)

The Simpson COLORSCOPE Model 458 is also useful to check the operation of the I and Q or R-Y and B-Y synchronous detectors, and the operation of the matrices. For these checks, it is most convenient to utilize a *COLOR-BAR GENERATOR* which provides the NTSC color-difference signals: ±I, ±Q, ±(R-Y), and ±(B-Y), and ±(G-Y). Fig. 5 shows a typical spectrum of *color-difference signals,* and the resulting scope patterns which

are obtained when the circuits indicated are in proper operating condition. The significant points in the patterns are the *nulls:* i.e., ±I must null through the Q channel, ±Q must null through the I channel; ±(R-Y) must null at the output of the blue video amplifier and at the output of the green video amplifier; ±(G-Y) must null at the output of the red video amplifier and at the output of the blue video amplifier; ±(B-Y) must null at the output of the red video amplifier and at the output of the green video amplifier.

DISPLAY OF CHROMINANCE RESPONSE CURVES

When chrominance frequency-response curves, such as shown in Fig. 6, are to be displayed on the scope screen, it is preferable to use the 300-kc position of the band switch. Although the bandwidth of the response curve shown in Fig. 6 is from 2.1 to 4.2 Mc, it does not follow that the COLORSCOPE is called upon to accommodate this range of frequencies in order to display the curve. Note that the curve has been demodulated by means of a demodulator probe, as shown in Fig. 7. After demodulation, the envelope frequencies only are applied to the scope; these frequencies are relatively low in value, and correspond in a general way to the frequencies contained in a 60-cycle square wave. The *demodulator probe* which is used in this test should have the characteristics of the SIMPSON MODEL 740 PEAK-TO-PEAK HIGH-FREQUENCY PROBE.

DISPLAY OF R-F AND I-F RESPONSE CURVES

The Simpson COLORSCOPE Model 458 is used in the conventional manner to display r-f and i-f response curves. In these applications, it is preferable to use the 300-kc position of the band switch. To obtain a *sharp and definite marker indication,*

as shown in Fig. 8, it is often necessary to use a 50,000-ohm filtering resistor between the scope and the signal take-off point in the receiver. This arrangement of series resistance working into the shunt capacitance of the shielded input cable provides a *low-pass filter action* which attenuates the higher beat frequencies and sharpens the marker indication. The Simpson Model 743 Probe is useful for this application.

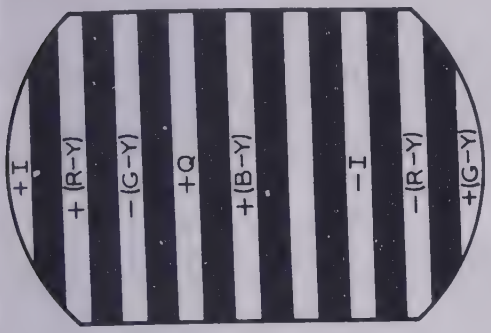


FIG. 5A. A TYPICAL COLOR-DIFFERENCE SPECTRUM FROM A COLOR-BAR GENERATOR. ON THE SCREEN OF THE PICTURE TUBE, THESE COLOR-DIFFERENCE BARS APPEAR AS FOLLOWS: +I, ORANGE; +(R-Y), BRIGHT RED; -(G-Y), MAGENTA; +Q, REDDISH BLUE; +(B-Y), BLUE; -I, CYAN; -(R-Y), BLUISH GREEN; +(G-Y), GREEN.

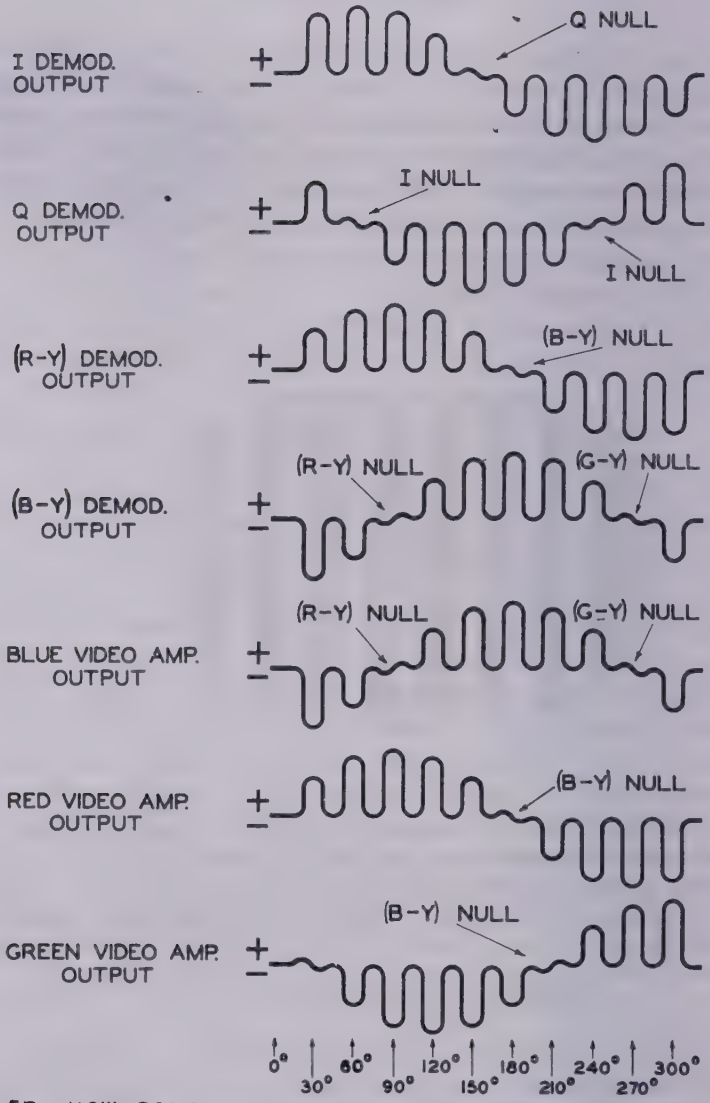


FIG. 5B. HOW COLOR-DIFFERENCE BAR SIGNALS APPEAR ON SCOPE SCREEN, AND NULL WHEN CIRCUITS ARE OPERATING PROPERLY.

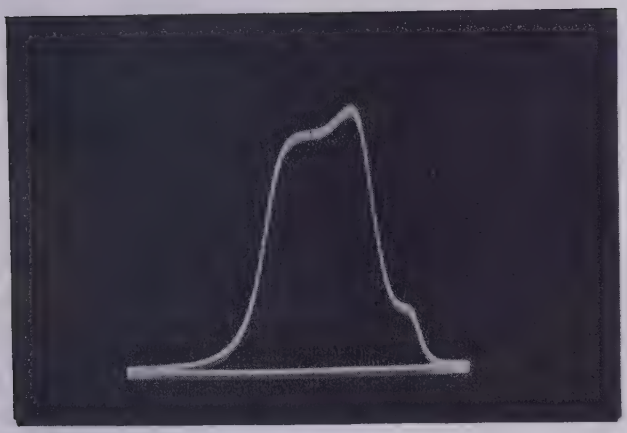


FIG. 6. TYPICAL RESPONSE OF THE FIRST CHROMA AMPLIFIER. THIS AMPLIFIER DIFFERS FROM A MONOCHROME VIDEO AMPLIFIER IN THAT THE RESPONSE IS OF THE BANDPASS TYPE, RATHER THAN OF THE LOW-PASS TYPE. THE PASS BAND EXTENDS FROM 2.1 TO 4.2 MC, IN ORDER TO FILTER OUT A MAXIMUM OF MONOCHROME INFORMATION AND TO PASS A MAXIMUM OF CHROMA INFORMATION TO THE I AND Q DEMODULATORS.

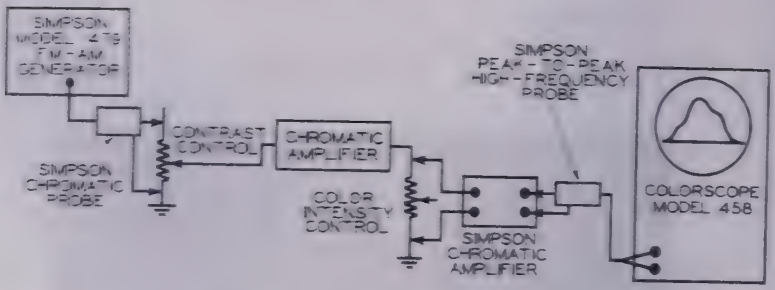
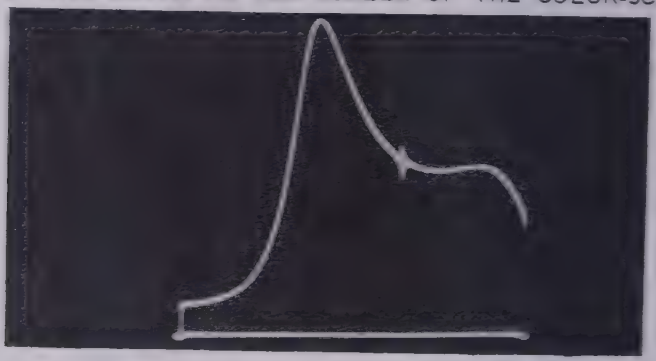


FIG. 7. TYPICAL TEST SET-UP UTILIZED TO OBTAIN THE FREQUENCY-RESPONSE CURVE OF THE CHROMA (BANDPASS) AMPLIFIER. THE SIMPSON CHROMATIC PROBE (10186) APPLIES A VIDEO-FREQUENCY SWEEP VOLTAGE ACROSS THE CONTRAST CONTROL; THE SIMPSON CHROMATIC AMPLIFIER MODEL 406 IS CONNECTED ACROSS A LOW-IMPEDANCE OUTPUT POINT (COLOR INTENSITY CONTROL); THE OUTPUT SIGNAL IS NEXT DEMODULATED BY THE PEAK-TO-PEAK HIGH-FREQUENCY PROBE, AND FINALLY DISPLAYED ON THE SCREEN OF THE COLOR-SCOPE.



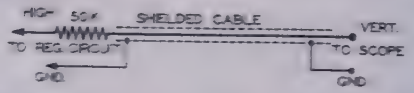
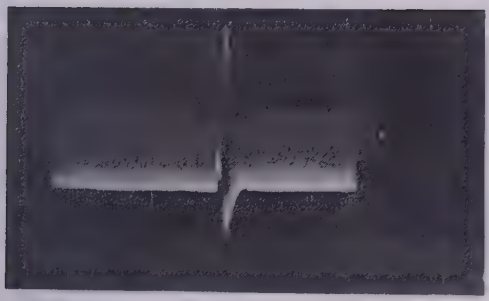
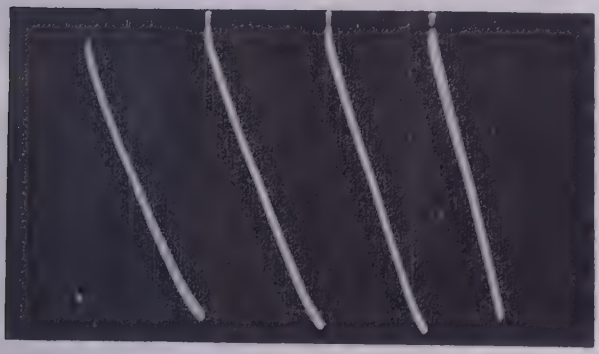


FIG. 8. (ABOVE) SHARP AND DEFINITE MARKER INDICATION OBTAINED WHEN MARKER IS PROPERLY FILTERED. (BELOW) SERIES RESISTOR WORKING INTO SHIELDED CABLE PROVIDES DESIRED MARKER FILTERING.





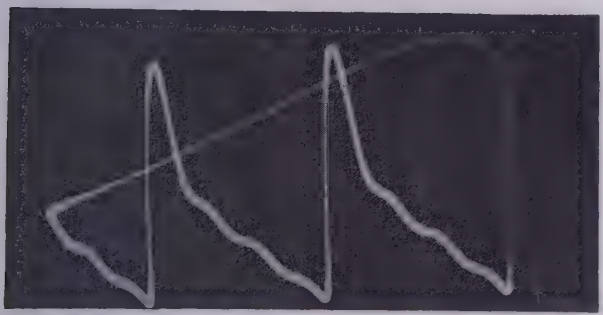


FIG. 9. TYPICAL WAVEFORMS ENCOUNTERED DURING THE COURSE OF TROUBLESHOOTING THE SYNC AND SWEEP CIRCUITS. WAVEFORM SHAPES ARE COMPARED WITH THE SPECIFIED WAVE-SHAPES IN THE RECEIVER SERVICE MANUAL, AND THE PEAK-TO-PEAK VOLTAGES OF THE WAVEFORMS ARE MEASURED.

TROUBLESHOOTING SYNC AND SWEEP CIRCUITS

Troubleshooting of sync and sweep circuits is facilitated by the COLORSCOPE because of its wide-band characteristics, which permit reproduction of waveforms such as illustrated in Fig. 9 with negligible distortion. The peak-to-peak voltages of any waveforms can be readily measured, as has been discussed above.

TO IDENTIFY PROPER WAVE SHAPE

Patterns are checked for *proper wave shape;* i.e., the wave shape observed on the scope screen is compared with the wave shape specified in the receiver service manual. *Peak-to-peak voltages* measured on the scope are likewise compared with specified values. In general, trouble is indicated in a sync or sweep circuit when the waveform voltage departs by more than 20% from the specified value. Of course, waveform voltage measurements must be made with rated line voltage (117 volts) applied to the receiver.

SQUARE-WAVE CHECKS OF VIDEO CIRCUITS

It is generally recognized that the ability of a receiver to reproduce a high-quality image depends, not only upon the uniformity of frequency response, but also upon the *transient response* of the receiver. The transient response of a circuit is usually checked by means of a *square-wave test.* Typical square-wave responses are shown in Fig. 10.

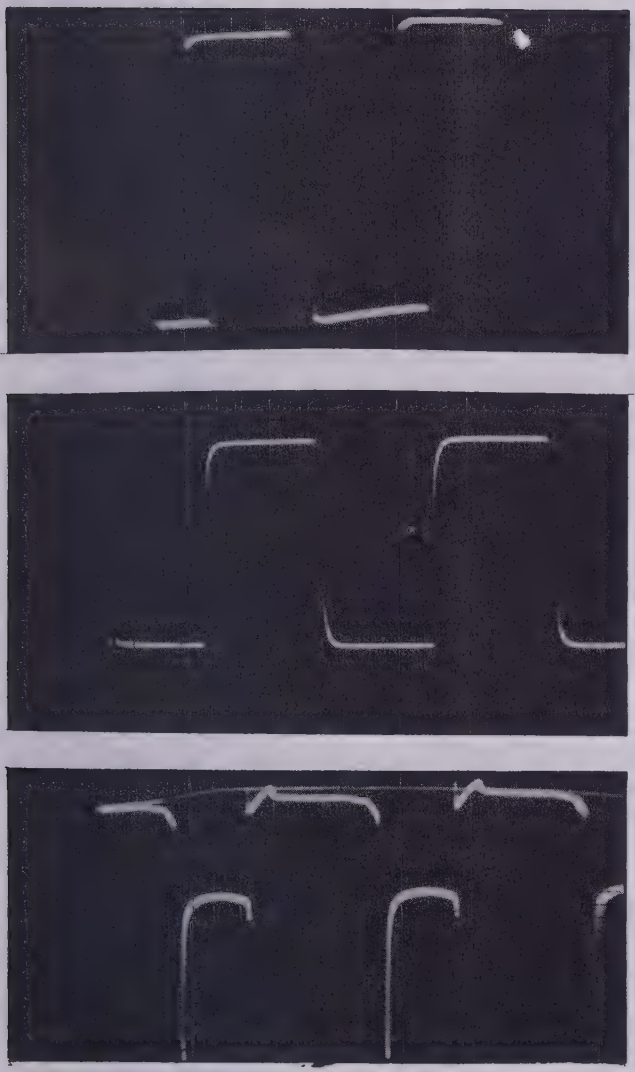


FIG. 10. SQUARE-WAVE RESPONSES. (A) SLIGHT TILT IN REPRODUCED SQUARE WAVE; (B) DIAGONAL CORNER ROUNDING; (C) ASYMMETRICAL OVERSHOOT.

WHY SQUARE-WAVE CHECKS ARE NECESSARY

Since there is a definite relation between frequency response and square-wave response, it is sometimes asked why square-wave checks should be made in addition to frequency-response tests. The reasons are as follows: (1) The relationship between frequency response and transient response is *not simple*, even for a single video stage. (2) Practical receiver arrangements utilize cascaded stages, in which it is almost *impossible to predict* the transient response with accuracy, upon the basis of the frequency responses of the individual stages.

CHROMA AMPLIFIER FOR A RISING RESPONSE

To provide an illustrative example of this situation, it may be observed that the r-f and i-f response of a receiver often has less response than would be desired at the high-frequency end. Manufacturing economies frequently impose less than the optimum number of tuned stages, so that the ideal over-all response curve cannot be obtained. In order to compensate for this deficiency insofar as possible, the chroma amplifier may be adjusted for a *rising response* at the high-frequency end. Insofar as frequency response alone is concerned, the signal circuits may be adjusted to provide uniform output in this manner.

RINGING TRANSIENT RESPONSE

However, frequency compensation brings with it a non-linear phase characteristic, which causes an *overshooting and ringing* transient response. A suitable compromise is usually necessary between frequency attenuation and transient distortion. For such tests, square-wave modulation provides definitive test results.

PHASE MEASUREMENTS BETWEEN TWO SIGNAL VOLTAGES

Although a square-wave test usually provides the quickest information concerning the phase characteristic of a circuit, it is sometimes desired to *measure exactly* the phase-angle difference between two signal voltages. For example, the high-fidelity audio worker may wish to measure the phase shift through a feedback loop. In such case, the input from the loop can be applied to the horizontal amplifier of the COLORSCOPE, and the output from the loop can be applied to the vertical amplifier.

SPECIAL SCOPE DISPLAYS

An elliptical pattern then appears on the scope screen, as shown in Fig. 11, and the deflection A divided by the deflection B gives the sine of the phase angle. Or, the phase angle is given by the inverse sine of A/B. Fig. 12 shows special displays of general interest.

ANTENNA AND FRONT-END IMPEDANCE MEASUREMENTS

Conditions of impedance match or mismatch, and measurement of the standing-wave ratio on a lead-in can be readily determined by means of the COLORSCOPE and sweep generator; tests can be made of antenna impedance, front-end impedance, interference-filter characteristics, etc. Because of space limitations, interested readers are referred to "TV TROUBLESHOOTING & REPAIR GUIDEBOOK," VOL. II, published by John F. Rider.

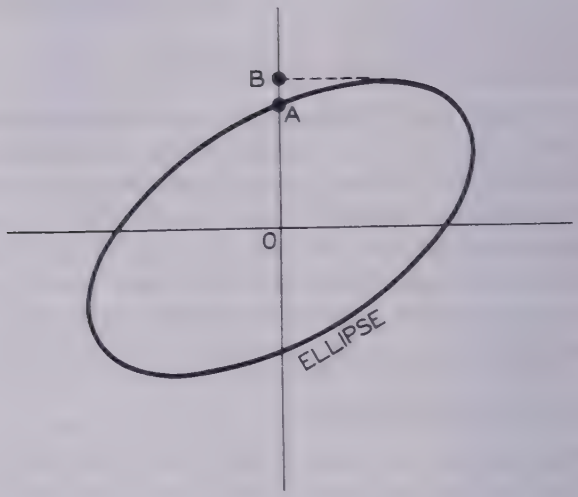


FIG. 11. WHEN ONE SINE-WAVE SIGNAL IS APPLIED TO THE VERTICAL AMPLIFIER OF THE SCOPE, AND ANOTHER SINE-WAVE SIGNAL IS APPLIED TO THE HORIZONTAL AMPLIFIER OF THE SCOPE, AN ELLIPTICAL PATTERN APPEARS ON THE SCOPE SCREEN. THE PHASE ANGLE BETWEEN THE TWO VOLTAGES IS EQUAL TO $\sin^{-1} A/B$, WHERE A IS THE DISTANCE OA AND B IS THE DISTANCE OB. THE MEASUREMENT IS INDEPENDENT OF THE SIGNAL VOLTAGES AND OF THE AMPLIFIER GAINS.

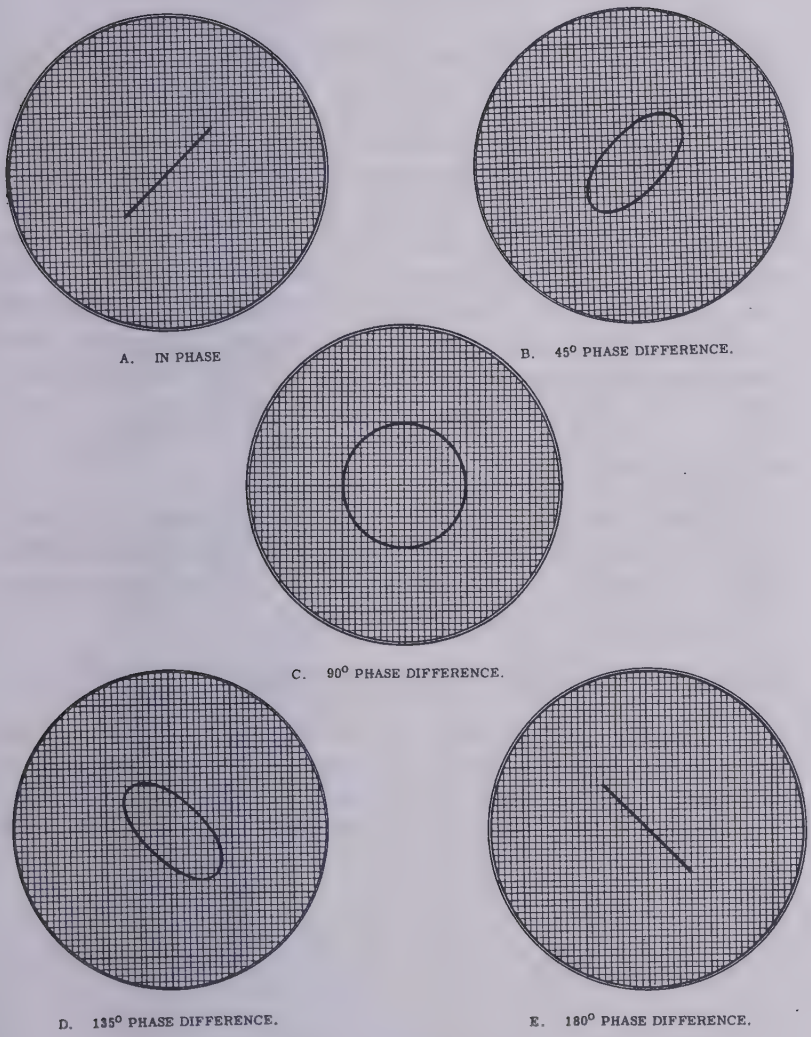


FIG. 12. LISSAJOU FIGURES SHOWING PHASE RELATIONS.

INDUSTRIAL ELECTRONIC APPLICATIONS

Applications of the COLORSCOPE in industrial electronics includes hydraulic tests, vibration and pressure tests, engine analysis, ignition checks, combustion analysis, watch timing, power-line fault location, dynamic balance tests, relay transit time measurements, high-speed (bullet, etc.) measurements, lens testing, acoustic determinations, checking of electronic control devices, testing of camera-shutter operation and photo-flash equipment, production quality of razor blades, soft drinks, and sheet thickness, measurements of torque, strain, vapor pressure, humidity, etc., etc.

FOR FURTHER DATA

For further treatment of such applications, the reader is referred to "ENCYCLOPEDIA OF CATHODE-RAY OSCILLOSCOPES AND THEIR USES," by John F. Rider, and to the extended bibliographical references which are noted.

APPLICATIONS IN THE TRANSMITTING STATION

The numerous applications of oscilloscopes in transmitting stations are discussed on the amateur level in the "ARRL HANDBOOK," published by the American Radio Relay League, and on the engineering level in the oscilloscope encyclopedia noted above.

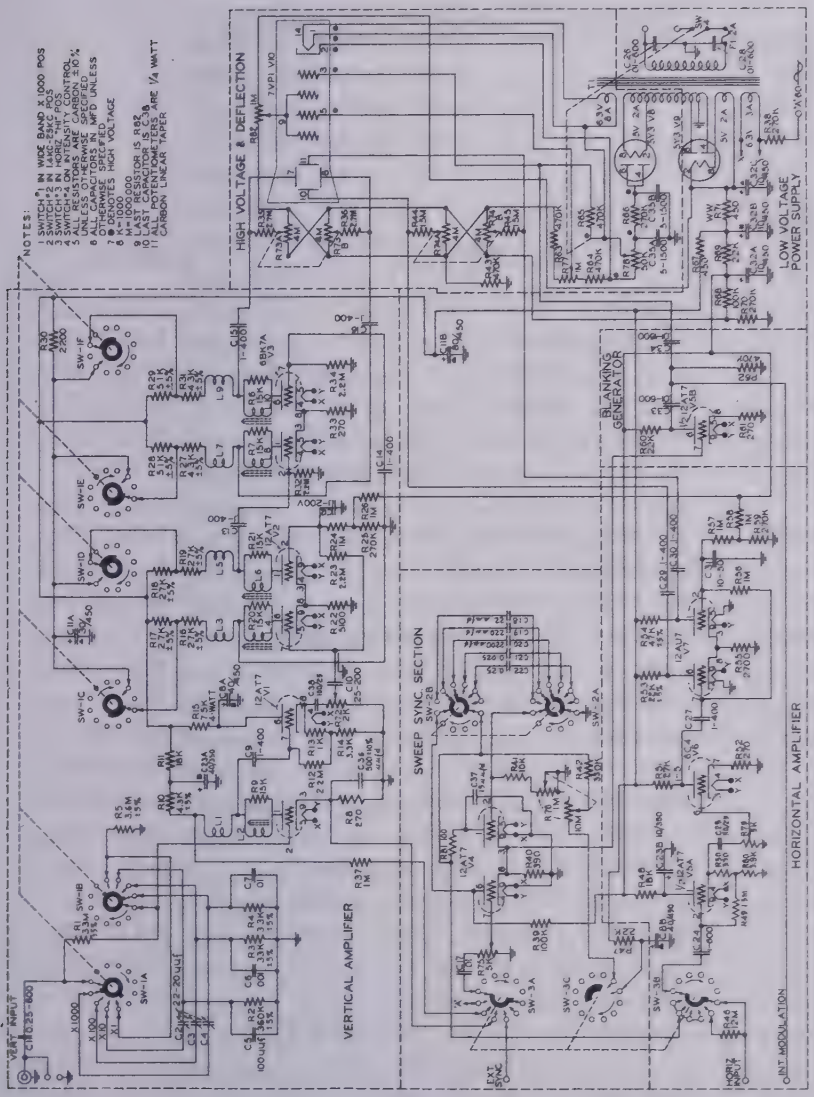

NOTES:
1 SWITCH #1 IN WIDE BAND X1000 POS
2 SWITCH #2 IN MEGACYC POS
3 SWITCH #3 IN HORIZ. HOLD CONTROL
4 SWITCH #4 IN VERT. GAIN CONTROL
5 ALL RESISTORS ARE CARBON ±10% UNLESS OTHERWISE SPECIFIED
6 ALL CAPACITORS ARE MYLAR UNLESS OTHERWISE SPECIFIED
7 ALL VOLTAGES ARE PEAK TO PEAK
8 ALL DIODES HIGH VOLTAGE
M=1000,000
9 LAST RESISTOR IS R82
10 LAST CAPACITOR IS C38
11 ALL POTENTIOMETERS ARE 1/4 WATT CARBON LINEAR TAPER
HIGH VOLTAGE & DEFLECTION
LOW VOLTAGE POWER SUPPLY
BLANKING GENERATOR
SWEEP SYNC SECTION
VERTICAL AMPLIFIER
HORIZONTAL AMPLIFIER
VERT. INPUT
INT. MODULATION
SYNC

FIG. 13. SIMPSON COLORSCOPE MODEL 458, SCHEMATIC DIAGRAM

TABLE OF COMPONENT PARTS

SYMBOL NO.	DESCRIPTION	SIMPSON PART NO.
C1	Capacitor, 0.25 μf, 600 v	1-112920
C2	Capacitor, trimmer	1-115573
C3	Capacitor, trimmer	1-115573
C4	Capacitor, trimmer	1-115573
C5	Capacitor, 100 μμf, 500 v, ceramic	1-113912
C6	Capacitor, 1000 μμf, 500 v, ceramic	1-115462
C7	Capacitor, 0.01 μf, 500 v, disk	1-115385
C8a,b	Capacitor, 40-40 μf, 450 v, electrolytic	1-115725
C9	Capacitor, 0.1 μf, 400 v	1-113901
C10	Capacitor, 0.25 μf, 200 v	1-114718
C11a,b	Capacitor, 80-30 μf, 450 v, electrolytic	1-115508
C12	Capacitor, 0.1 μf, 200 v	1-114400
C13	Capacitor, 0.1 μf, 400 v	1-113901
C14	Capacitor, 0.1 μf, 400 v	1-113901
C15	Capacitor, 0.1 μf, 400 v	1-113901
C16	Capacitor, 0.1 μf, 400 v	1-113901
C17	Capacitor, 0.01 μf, 600 v	1-115504
C18	Capacitor, 22 μμf, 500 v, ceramic	1-115503
C19	Capacitor, 220 μμf, 500 v, ceramic	1-113854
C20	Capacitor, 2200 μμf, 500 v, ceramic	1-115502
C21	Capacitor, 0.02 μf, 400 v	1-113898
C22	Capacitor, 0.25 μf, 200 v	1-114718
C23a,b	Capacitor, 10 μf @ 450 v, 40 μf @ 350 v, electrolytic	1-113963
C24	Capacitor, 0.1 μf, 600 v	1-111679
C25	Capacitor, 50 μf, 25 v, electrolytic	1-116001

TABLE OF COMPONENT PARTS

C26	Capacitor, 0.01 μf, 600 v	1-115504
C27	Capacitor, 0.1 μf, 400 v	1-113901
C28	Capacitor, 0.01 μf, 600 v	1-115504
C29	Capacitor, 0.1 μf, 400 v	1-113901
C30	Capacitor, 0.1 μf, 400 v	1-113901
C31	Capacitor, 10 μf, 50 v, electrolytic	1-115506
C32a,b,c	Capacitor, 10-10-10 μf, 450 v, electrolytic	1-113962
C33	Capacitor, 0.01 μf, 600 v	1-115504
C34	Capacitor, 0.01 μf, 1600 v	1-115505
C35	Capacitor, 0.5-0.5 μf, 1500 v, oil filled	1-115500
C36	Capacitor, 500 μμf, 500 v, ceramic	1-115945
C37	Capacitor, 15 μμf, 500 v, ceramic	1-115464
C38	Capacitor, 100 μf, 25 v, electrolytic	1-115507
R1	Resistor, 3.3 M ±5%, ½ w	1-115947
R2	Resistor, 360 K ±5%, ½ w	1-115950
R3	Resistor, 33 K ±5%, ½ w	1-115949
R4	Resistor, 3.3 K ±5%, ½ w	1-115948
R5	Resistor, 3.6 M ±5%, ½ w	1-115951
R6	Resistor, 15 K ±10%, ½ w	1-111678
R7	Resistor, 15 K ±10%, ½ w	1-111678
R8	Resistor, 270 ohms ±10%, ½ w	1-115386
R9	Resistor, 15 K ±10%, ½ w	1-111678
R10	Resistor, 4.3 K ±5%, 1 w	1-115753
R11	Resistor, 18 K ±10%, 1 w	1-115491
R12	Resistor, 2.2 M ±10%, ½ w	1-114683
R13	Resistor, 1 K ±10%, ½ w	1-111689
R14	Resistor, 3.3 K ±10%, ½ w	1-114225
R15	Resistor, 7.5 K ±10%, 4 w	1-115582
R16	Resistor, 2.7 K ±5%, 1 w	1-115805
R17	Resistor, 2.7 K ±5%, 1 w	1-115805
R18	Resistor, 2.7 K ±5%, 1 w	1-115805
R19	Resistor, 2.7 K ±5%, 1 w	1-115805
R20	Resistor, 15 K ±10%, ½ w	1-111678
R21	Resistor, 15 K ±10%, ½ w	1-111678
R22	Resistor, 5.1 K ±5%, 1 w	1-115495

R23	Resistor, 2.2 M ±10%, ½ w	1-114683
R24	Resistor, 1 M ±10%, ½ w	1-113952
R25	Resistor, 270 K ±10%, ½ w	1-115497
R26	Resistor, 1 M ±10%, ½ w	1-113952
R27	Resistor, 4.3 K ±5%, 1 w	1-115753
R28	Resistor, 5.1 K ±5%, 1 w	1-115495
R29	Resistor, 5.1 K ±5%, 1 w	1-115495
R30	Resistor, 2.2 K ±10%, 1 w	1-113930
R31	Resistor, 4.3 K ±5%, 1 w	1-115753
R32	Resistor, 2.2 M ±10%, ½ w	1-114683
R33	Resistor, 270 ohms ±10%, ½ w	1-115386
R34	Resistor, 2.2 M ±10%, ½ w	1-114683
R35	Resistor, 2.7 M ±10%, ½ w	1-114779
R36	Resistor, 2.7 M ±10%, ½ w	1-114779
R37	Resistor, 1 M ±10%, ½ w	1-113952
R38	Resistor, 270 K ±10%, ½ w	1-115497
R39	Resistor, 100 K ±10%, ½ w	1-113949
R40	Resistor, 390 ohms ±10%, ½ w	1-115946
R41	Resistor, 10 K ±10%, ½ w	1-111671
R42	Resistor, 330 K ±10%, ½ w	1-113950
R43	Resistor, 470 K ±10%, 1 w	1-115492
R44	Resistor, 1.5 M ±10%, ½ w	1-113621
R45	Resistor, 1.5 M ±10%, ½ w	1-113621
R46	Resistor, 12 M ±10%, ½ w	1-113953
R47	Resistor, 22 K ±10%, 1 w	1-114347
R48	Resistor, 18 K ±10%, ½ w	1-113943
R49	Resistor, 1.5 M ±10%, ½ w	1-113621
R50	Resistor, 330 ohms ±10%, ½ w	1-115960
R51	Resistor, 27 K ±10%, 2 w	1-115957
R52	Resistor, 270 ohms ±10%, ½ w	1-115386
R53	Resistor, 22 K ±5%, 1 w	1-115959
R54	Resistor, 47 K ±5%, 1 w	1-115958
R55	Resistor, 2.7 K ±10%, ½ w	1-113942
R56	Resistor, 1 M ±10%, ½ w	1-113952
R57	Resistor, 1 M ±10%, ½ w	1-113952

R58	Resistor, 1 M ±10%, ½ w	1-113952
R59	Resistor, 270 K ±10%, ½ w	1-115497
R60	Resistor, 22 K ±10%, 1 w	1-114347
R61	Resistor, 270 ohms ±10%, ½ w	1-115386
R62	Resistor, 470 K ±10%, ½ w	1-114227
R63	Resistor, 470 K ±10%, 1 w	1-115492
R64	Resistor, 470 K ±10%, 1 w	1-115492
R65	Resistor, 470 K ±10%, ½ w	1-114227
R66	Resistor, 270 K ±10%, 1 w	1-115726
R67	Resistor, 450 ohms ±10%, 4 w	1-115490
R68	Resistor, 100 K ±10%, ½ w	1-113949
R69	Resistor, 22 K ±10%, 2 w	1-115956
R70	Resistor, 270 K ±10%, ½ w	1-115497
R71	Resistor, 450 ohms ±10%, 7 w	1-115489
R72	Potentiometer, 2 K ±20%, ¼ w	1-115723
R73	Potentiometer, dual 4 M-4 M ±20%	1-115486
R74	Potentiometer, dual 4 M-4 M ±20%	1-115486
R75	Potentiometer, 5 K ±20%, ¼ w	1-115484
R76	Potentiometer, dual 1 M-10 M ±30%	1-115485
R77	Potentiometer, 1 M ±20%, ¼ w	1-115473
R78	Potentiometer, 50 K ±20%, ¼ w	1-115487
R79	Potentiometer, 5 K ±20%, ¼ w	1-115484
R80	Resistor, 3.8 K ±10%, ½ w	1-113045
R81	Resistor, 100 ohms ±10%, ½ w	1-115348
R82	Potentiometer, 1 M ±20%, ¼ w	1-115473
SW1	Switch, VERTICAL MULTIPLIER	1-115510
SW2	Switch, COARSE FREQ	1-115512
SW3	Switch, HORIZONTAL FUNCTION	1-115511
SW4	Switch (Part of R78)	
V1	Tube, 12AT7	1-115466
V2	Tube, 12AT7	1-115466
V3	Tube, 6BK7A	1-115728
V4	Tube, 12AT7	1-115466

TABLE OF COMPONENT PARTS

V5	Tube, 12AT7	1-115466
V6	Tube, 6C4	1-113975
V7	Tube, 12AU7	1-114083
V8	Tube, 5Y3	1-114671
V9	Tube, 5Y3	1-114671
V10	Cathode Ray Tube, 7VP1 or 7JP1	1-115518
PL1	Pilot lamp, #47	1-113747
L1	Peaking coil, fixed	1-115378
L2	Peaking coil, variable	1-115379
L3	Peaking coil, fixed	1-115378
L4	Peaking coil, variable	1-115379
L5	Peaking coil, fixed	1-115378
L6	Peaking coil, variable	1-115379
L7	Peaking coil, fixed	1-115378
L8	Peaking coil, variable	1-115379
L9	Peaking coil, fixed	1-115378
L10	Peaking coil, variable	1-115379
	Transformer, power	1-115538
	Bezel, Cathode Ray Tube	1-115636
	Fuse, 2 amp 3AG	1-112911
	Knob, 1¼''	1-115548
	Knob, ¾''	1-115648
	Graticule	1-115743
	Graticule Retaining Ring	1-115637
	Connecting Cable	10-830074

ASTIGMATISM CONTROL

The astigmatism control helps to maintain an equal illumination at all points on the face of the cathode ray tube. To adjust it, connect a wire from the CALIBRATED PEAK-TO-PEAK terminal, on the front panel, to the vertical input. Set the vertical multiplier at X10. Adjust the vertical gain control and the horizontal gain control for a good sine wave with approximately four inches deflection. Set intensity and focus controls for the clearest trace. Then adjust the astigmatism control for sharpest trace over the entire pattern.

VERTICAL MULTIPLIER (STEP ATTENUATOR)

There are three adjustable trimmer capacitors which are used in conjunction with the vertical multiplier switch circuit. They are capacitors C2, C3, and C4. They are located inside the oscilloscope on the left hand side of the chassis mounting bracket, and are immediately behind the front panel. Fig. 14 shows that the top control is C2; the center is C3; and the lower one is C4. Capacitor C2 corrects the frequency response of the vertical amplifier when the vertical multiplier is in its X10 position. Capacitor C3 is for the X100 position, and C4 is for the X1000 position.

To adjust these trimmers, connect the output of a square wave generator, set at 1000 cycles, to the vertical input of the oscilloscope. With the vertical multiplier set at its X10 position, adjust the output from the square wave generator and the vertical gain in the oscilloscope for a satisfactory 4-inch pattern. Then adjust capacitor C2 for the best *flat top* trace, such as shown in Fig. 15. Repeat this procedure for the X100 position (adjusting C3) and for the X1000 position (adjusting C4).

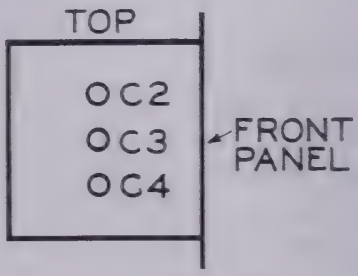


FIG. 14. LOCATION OF THE TRIMMER CAPACITORS USED TO ADJUST FREQUENCY RESPONSE FOR THE VERTICAL AMPLIFIER.

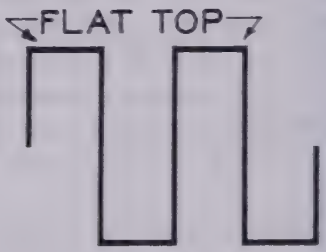


FIG. 15. SAMPLE SQUARE WAVE TRACE WHICH INDICATES RESPONSE CHARACTERISTICS OF THE VERTICAL AMPLIFIER CIRCUIT.

Vertical Amplifier Frequency Response
Wide Band Position
From 20 cycles/sec to 4.5 mc/sec — flat within ±1 db
From 10 cycles/sec to 5.0 mc/sec — flat within ±2 db
Full response at the Burst Frequency (3.58 mc/sec)

Narrow Band Position
From 20 cycles/sec to 200 kc/sec — flat within ±1 db
From 10 cycles/sec to 300 kc/sec — flat within ±2 db

Rise Time (Wide Band Position) less than 0.05 microsecond

Vertical Deflection Sensitivity
Wide Band Position — 40 millivolts R.M.S./inch (Minimum)
Narrow Band Position — 15 millivolts R.M.S./inch (Minimum)

Horizontal Amplifier Frequency Response
From 20 cycles/sec to 200 kc/sec — flat within ±1 db
From 10 cycles/sec to 300 kc/sec — flat within ±2 db

Horizontal Deflection Sensitivity
Horizontal Input "Hi" — 115 millivolts R.M.S./inch (Minimum)
Horizontal Input "Low" — 1.4 volts R.M.S./inch (Minimum)

Z-axis Sensitivity (Voltage to blank beam) — less than 4.0 volts R.M.S.
Calibrating Voltage (at 117.5 VAC input) — 18 volts P-P ±10%
Maximum Signal Input Voltage — 600 volts peak
Input Resistance (Minimum) — 3.3 megohms ±10%
Input Capacitance at 5 megacycles/sec — 20 $\mu\mu$f ±10%
Sawtooth Sweep Range — 14 cycles/sec to 250 kc/sec
Power Consumption (at 117.5 VAC input) — 80 watts ±10%
Case Dimensions (Overall) — 11" wide x 14½" high x 16⅜" deep
Net Weight — 29 lbs.

Simpson VARIDOT GENERATOR

MODEL 434

Lets You Adjust the Number and Size of Dots to Your Own Liking

The Simpson Model 434 provides white dot patterns with variable dot size (from 1 to 8 scanning lines, with corresponding dot widths), and variable dot number, from 6 to 12 horizontal dots, and 6 to 12 vertical dots.

Horizontal and vertical sync pulses are provided, with adjustable vertical sync which can be operated at line frequency or off line frequency. This also operates as a hum-check control.

Modulated r-f output is available, operating on fundamentals from Channel 2 to Channel 6. Positive or negative video output is also available. Line Voltage: 117 Volts, 50-60 cycles, 45 watts. Weight is approximately 11½ lbs.

Model 434 complete with operating instructions **$147.50**

WARRANTY

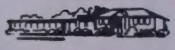
SIMPSON ELECTRIC COMPANY warrants each instrument and other articles of equipment manufactured by it to be free from defects in material and workmanship under normal use and service, its obligation under this warranty being limited to making good at its factory any instrument or other article of equipment which shall within 90 days after delivery of such instrument or other article of equipment to the original purchaser be returned intact to it, or to one of its authorized service stations, with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on its part, and SIMPSON ELECTRIC COMPANY neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sale of its products.

This warranty shall not apply to any instrument or other article of equipment which shall have been repaired or altered outside the SIMPSON ELECTRIC COMPANY factory or authorized service stations, nor which has been subject to misuse, negligence or accident, incorrect wiring by others, or installation or use not in accord with instructions furnished by the manufacturer.

Simpson ELECTRIC COMPANY

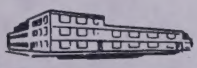
5200 Kinzie St., Chicago 44, Illinois • Phone: ESlebrook 9-1121

In Canada: Bach-Simpson, Ltd., London, Ontario



LAC DU FLAMBEAU PLANT
WISCONSIN

LAKE STREET PLANT
CHICAGO



KINZIE STREET PLANT
CHICAGO

AURORA PLANT
AURORA, ILL.

Quality is the indispensable component of every Simpson instrument . . . . . .